

Remarks/ Arguments

Claims 1 to 30 are pending in this patent application. Claims 1 and 11 to 16 have been amended, without prejudice, to more clearly define Applicants' claimed invention. Support for the foregoing amendments is found throughout Applicants' specification such as, for example, at page 7, paragraphs [0035] and [0036], as well as in original claim 16. Claims 20 to 30 have been withdrawn from consideration in view of the provisional election made by Mr. Geoffrey Chase on September 7, 2005, subject to Applicants' traversal detailed below. No new matter has been added.

The Action includes rejections under 35 U.S.C. §§ 103(a) and 112, second paragraph. In view of the foregoing amendments and the following remarks, reconsideration and withdrawal of the rejections are requested respectfully.

Discussion of the Election/Restriction Requirement

The Action requires Applicants to elect for prosecution either the claims of Group I (Claims 1 to 19 drawn to a method) or the claims of Group II (Claims 20 to 30 drawn to a composition). Applicants hereby affirm their election of Group I, with traverse.

For a restriction requirement to be proper, the Examiner must show that a serious burden exists if the claims of Groups I and II are examined together. M.P.E.P. § 803 (8th ed., August 2001). In this regard, the Action has provided **no** evidence or reasoning to show that the requisite serious burden exists. Upon closer inspection of the claims, it is indeed reasonable to conclude that examining all of the claims together would **not** impose a serious burden on the Patent Office to examine all of the present claims because the subject matter of these claims is sufficiently related such that a search of the claims in any one Group would encompass a search for the subject matter of the other Group. Indeed, the same compounds recited in process Claim 2 are recited in composition Claim 20. Thus, a search

for the methods of claims 1 to 19 should be all-inclusive with respect to the compositions of Claims 20 to 30. Accordingly, reconsideration and withdrawal of the restriction requirement is requested respectfully.

Discussion of the Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 12 and 14 to 16 have been rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicants regard as their invention. Although Applicants disagree respectfully that Claims 12 and 14 to 16 are unclear, Applicants submit that the foregoing amendments address the concerns raised in the Action thus rendering the rejection moot. Accordingly, reconsideration and withdrawal of the rejection is requested respectfully.

Discussion of the Rejections Under 35 U.S.C. § 103(a)

Claims 1 to 19 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over either U.S. Patent No. 6,365,231 to Sato al. ("the Sato patent") or U.S. patent application Publication No. 2005/0048204 to Dussarrat et al. ("the Dussarrat publication"). Applicants respectfully traverse this rejection because the Sato patent and the Dussarrat publication are incapable of providing the requisite art-suggested motivation to modify their teachings in such a way that would produce Applicants' claimed invention.

"A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field." *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1316 (Fed. Cir. 2000). "The invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time." *In re Dembiczak*, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999) (quoting *Interconnect Planning*

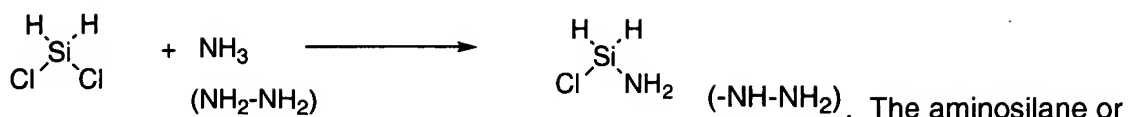
Corp. v. Feil, 227 U.S.P.Q. 543, 547 (Fed. Cir. 1985). To establish a *prima facie* case of obviousness, “the examiner must show reasons that the skilled artisan, confronted with the same problem as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.” *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1458 (Fed. Cir. 1998).

Applicants’ claimed invention defines a process for the chemical vapor deposition of material selected from the group consisting of silicon nitride, silicon oxide, and silicon oxynitride on a substrate using a hydrazinosilane of the formula:

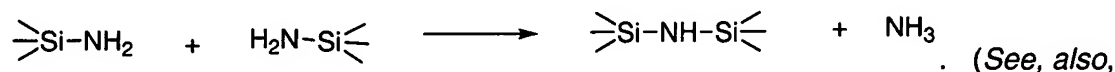


where each R^1 is independently selected from alkyl groups of C_1 to C_6 ; each R^2 is independently selected from the group consisting of hydrogen, alkyl, vinyl, allyl, and phenyl; and $n = 1-4$ (see, e.g., amended claim 1). The recited formula defines a **hydrazinosilane**. Thus, the present invention delivers hydrazinosilanes as the **actual precursors** in a chemical vapor deposition (“CVD”) process. The prior art of record does not teach or suggest introducing a hydrazinosilane as a CVD precursor and, in fact, to the extent that hydrazinosilanes are employed in the prior art, they are unstable, transient species produced *in situ* as the result of a reaction between onther precursors.

In this regard, both the Sato patent and the Dussarrat publication disclose processes for forming silicon nitride films by CVD by employing the reaction of chlorosilanes or organoaminosilanes with ammonia or other nitrogen containing-compounds such as, e.g., hydrazines, to first form either an aminosilane or a hydrazinosilane *in situ*. For example, the Sato patent teaches the reaction of chlorosilane with ammonia. In this step, chlorine or hydrogen on the silicon is replaced by an amino group to form Si-NH_2 bond:



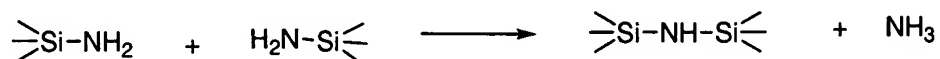
The aminosilane or hydrazinosilane then undergoes a rapid intra-molecular condensation to form the Si-NH-Si link:



(See, also, the Dussarrat publication at pages 2 to 3). The process of the present invention, in contrast, completely eliminates the first step because the process of the present invention employs **stable hydrazinosilanes** for use as the **actual precursors** in a CVD process. By eliminating this first step, Applicants' precursors can deposit silicon nitride, for example, at a temperature 200-300°C lower than the Sato and Dussarrat processes. This is very significant because it reduces the thermal budget for semiconductor manufacturers.

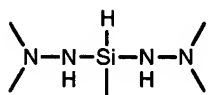
Applicants submit respectfully that one of ordinary skill in the art at the time of the present invention and presented with the Sato patent and the Dussarrat publication would **not** have been motivated to modify such teachings in a way that would eliminate one of the disclosed process steps (*i.e.*, formation of the hydrazinosilane by CVD) and to, instead, use hydrazinosilane as a CVD precursor. The Action mistakenly asserts that the motivation would derive from the realization "that the use of an organic silane compound reacted with hydrazine suggests to utilize a[n] organic silane with hydrazine *i.e.* hydrazinosilane. Hence, it would have been obvious to utilize a hydrazinosilane with the expectation of obtaining similar results" (Action at 4 to 5). It simply does not follow, however, that one of ordinary skill in the art presented with the Sato and Dussarrat's teaching of reacting an organic silane with a hydrazine would have motivated to use the hydrazinosilane as a CVD **precursor** because the hydrazinosilanes disclosed in the Sato patent and the Dussarrat publication are **so unstable, they can only be generated in situ**. In this regard, the hydrazinosilanes

disclosed in the Sato patent and the Dussarrat publication can **only be generated as transient species** in reaction because they include an unsubstituted nitrogen atoms that, as detailed above, undergo a rapid inter-molecular condensation reaction because of the activity of the N-H bond:

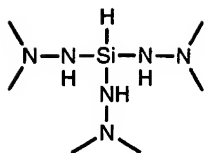


Such hydrazinosilanes without substituents on the nitrogen are so unstable that they do not exist under normal conditions and, thus, can not be prepared and isolated by regular synthetic processes. Accordingly, the hydrazinosilanes disclosed by Sato and Dussarrat can only be generated ***in situ***.

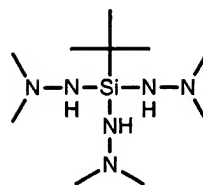
In contrast, Applicants have surprisingly discovered that **stable** hydrazinosilanes can be made and used as CVD precursors by sterically hindering the nitrogens in the hydrazinosilane molecules. For example, by using 1,1-dimethylhydrazine, the two hydrogens on the β -position are replaced by methyl groups. The two or three $\text{Me}_2\text{N-}$ groups in conjunction with the R groups on the silicon efficiently shield the α -N-H bonds of the hydrazino groups and make them **unaccessible** for inter-molecular condensation. Examples of stable hydrazinosilanes contemplated by the present invention include compounds A-I below, which are found at page 9 of the present specification and which are reproduced for the Examiner's convenience.



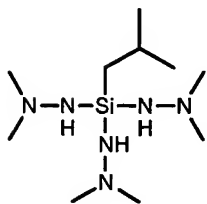
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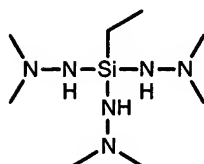
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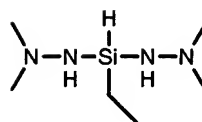
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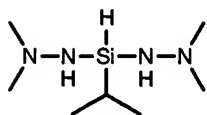
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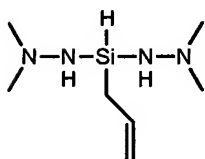
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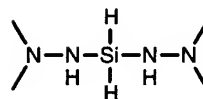
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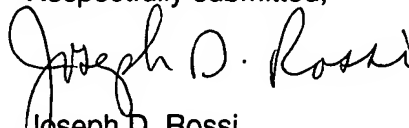
In sum, it is only with the improper use of hindsight and with the benefit of the Applicant's disclosure that one can discern the desirability of their claimed invention from that disclosed by Sato and Dussarrat. Indeed, the hydrazinosilanes disclosed by Sato and Dussarrat were generated *in situ* for a reason – it was well known in the art that such compounds were so unstable that they could not be isolated. As such Sato and Dussarrat are **completely incapable** of providing the requisite art-suggested motivation to modify their teachings in such a way as to obtain a **stable** hydrazinosilane as defined by Applicants' claimed invention. Accordingly, reconsideration and withdrawal of the rejection is respectfully requested.

Conclusion

Applicants believe that the foregoing constitutes a complete and full response to the Action of record. Applicants respectfully submit that this application is now in condition for allowance. Accordingly, an indication of allowability and an early Notice of Allowance are respectfully requested.

The Commissioner is hereby authorized to charge the fee required and any additional fees that may be needed to Deposit Account No. 01-0493 in the name of Air Products and Chemicals, Inc.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Joseph D. Rossi". The signature is fluid and cursive, with the first name "Joseph" and last name "Rossi" clearly legible.

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